PURDUE UNIVERSITY

CAPSTONE EXPERIENCE 2015

Agricultural & Biological ENGINEERING

Profitable, Waste Reducing Plant Design for Production of Salsa

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Background

Problem Statement: It is estimated that over half of the produce from the student run farm at Purdue is discarded because it goes unused.

Aim: Design a profitable plant for producing salsa using vegetables produced at the student run farm, thereby reducing waste.

Objectives:

- Design and optimize unit operations for the plant
- Develop sustainable processes to minimize environment and energy impact
- Determine selling price for 20% ROI
- Create employment opportunities for students

Market Analysis

Findings:

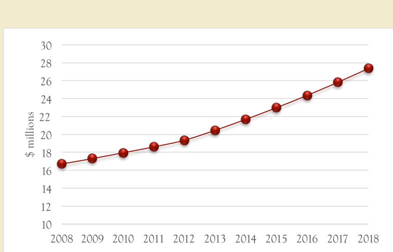


Fig 1: Indiana Sales Market

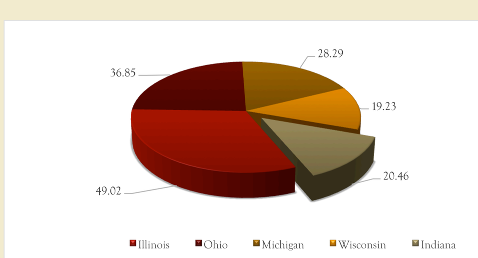


Fig 2: Great Lakes Region Salsa Market

Demand for Salsa at Purdue: Data provided by the food Services department at Purdue gave us the demand for salsa on campus. As a new business, our product will aim to take close to 10% of the market's share.

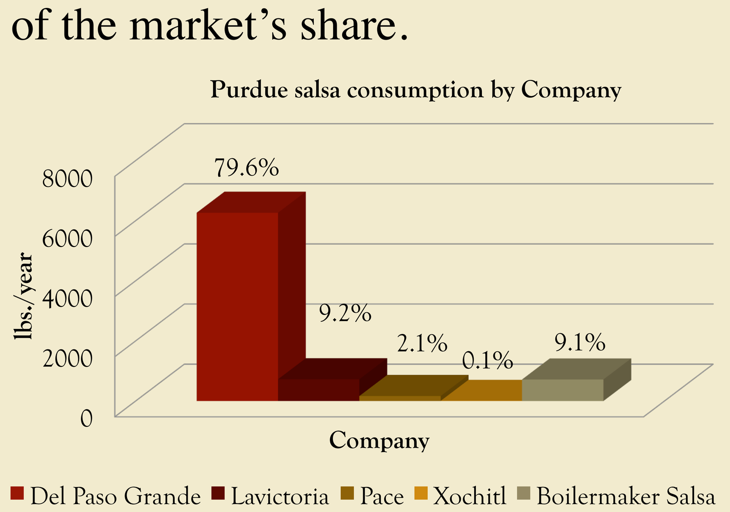
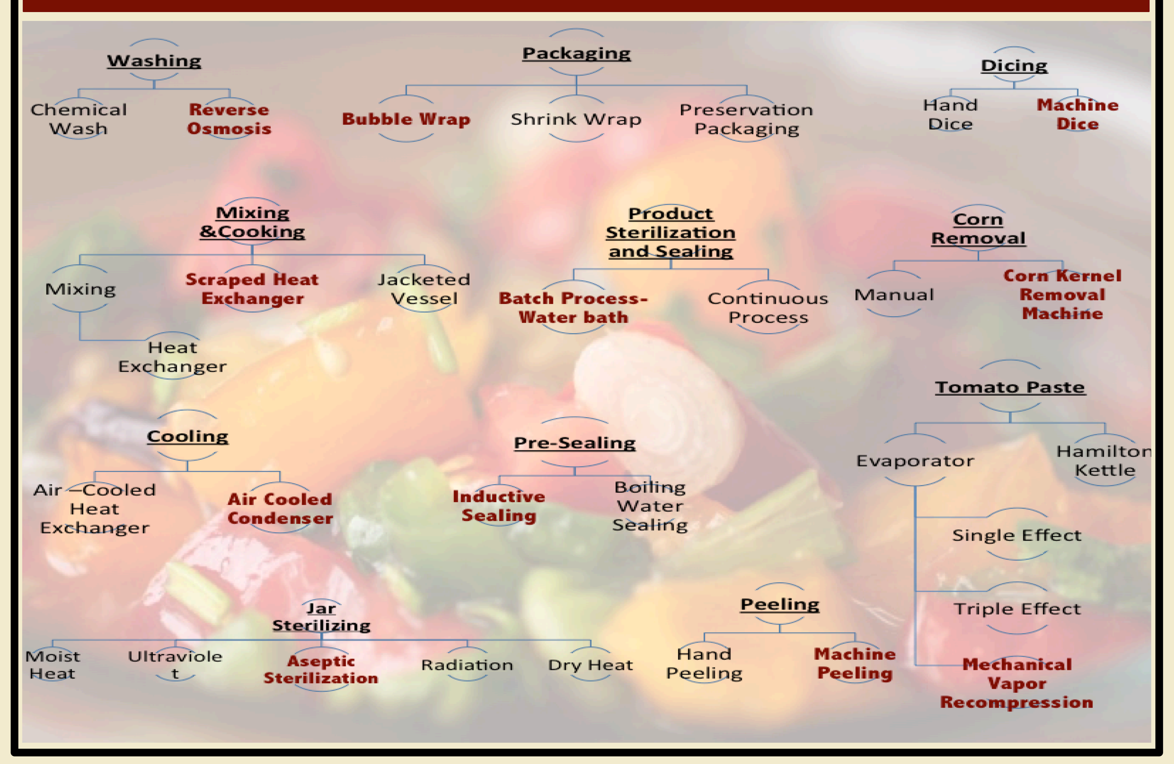


Fig 3: Boilermaker Salsa and competing brands

SWOT Analysis

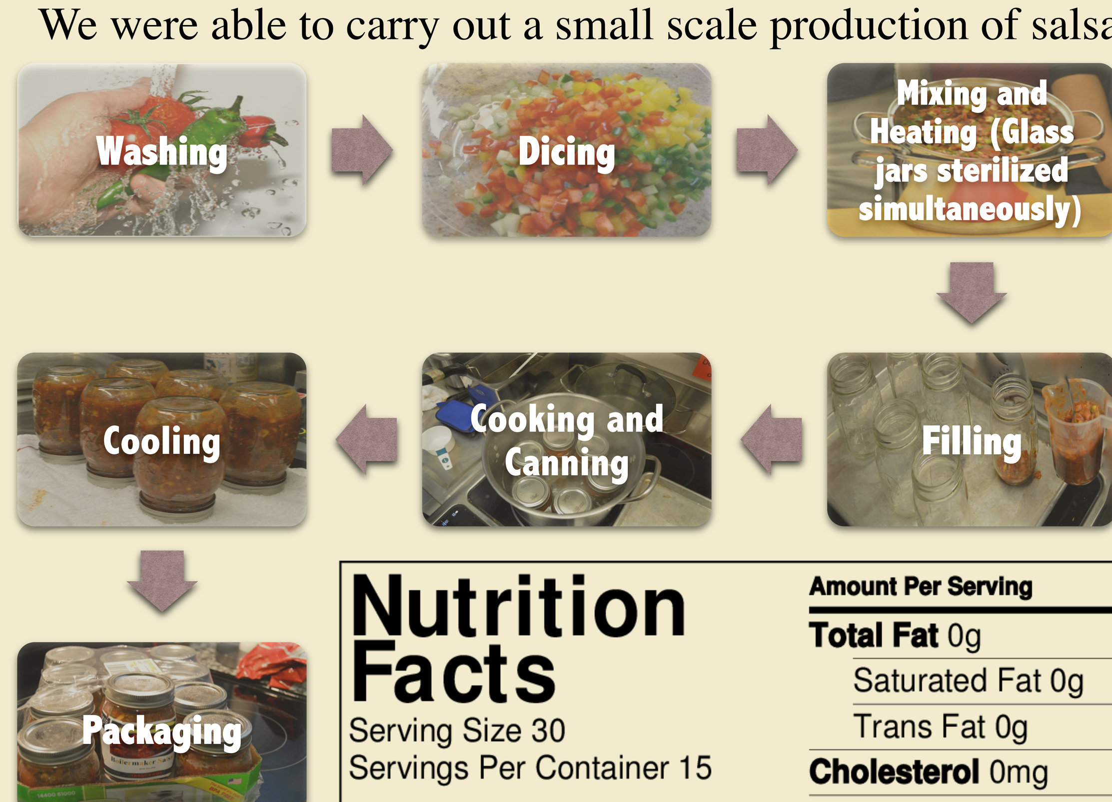
Strengths	Weaknesses
• The market shows a rise in salsa purchases for the past several years • All vegetables are sourced locally from the Purdue community • There is an educational benefit to students employed by the production process.	• The annual yield of product is small as compared to larger producers • Production will be limited to harvest months • Though the salsa market is rising, it remains a small fraction of the overall food buying market.
Opportunities	**Threats**
• Production can easily be expanded and modified to accommodate different products • There are market opportunities outside of the Purdue community to include local supermarkets and grocery stores	• Production hinges on the productivity of the Student Run Farm • Purdue may pull funding from the operation and halt production

Morphological Analysis



Experiment

We were able to carry out a small scale production of salsa.



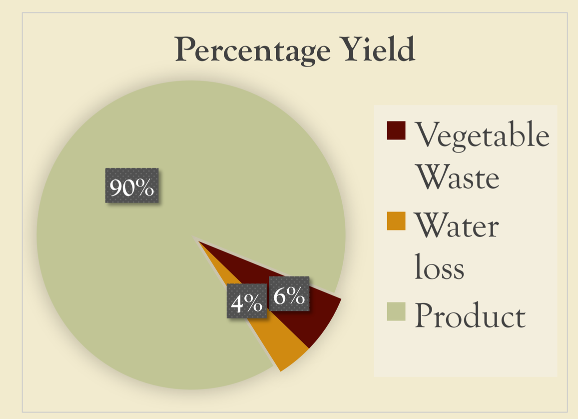


Fig 4: Percentage yield from kitchen lab experiment

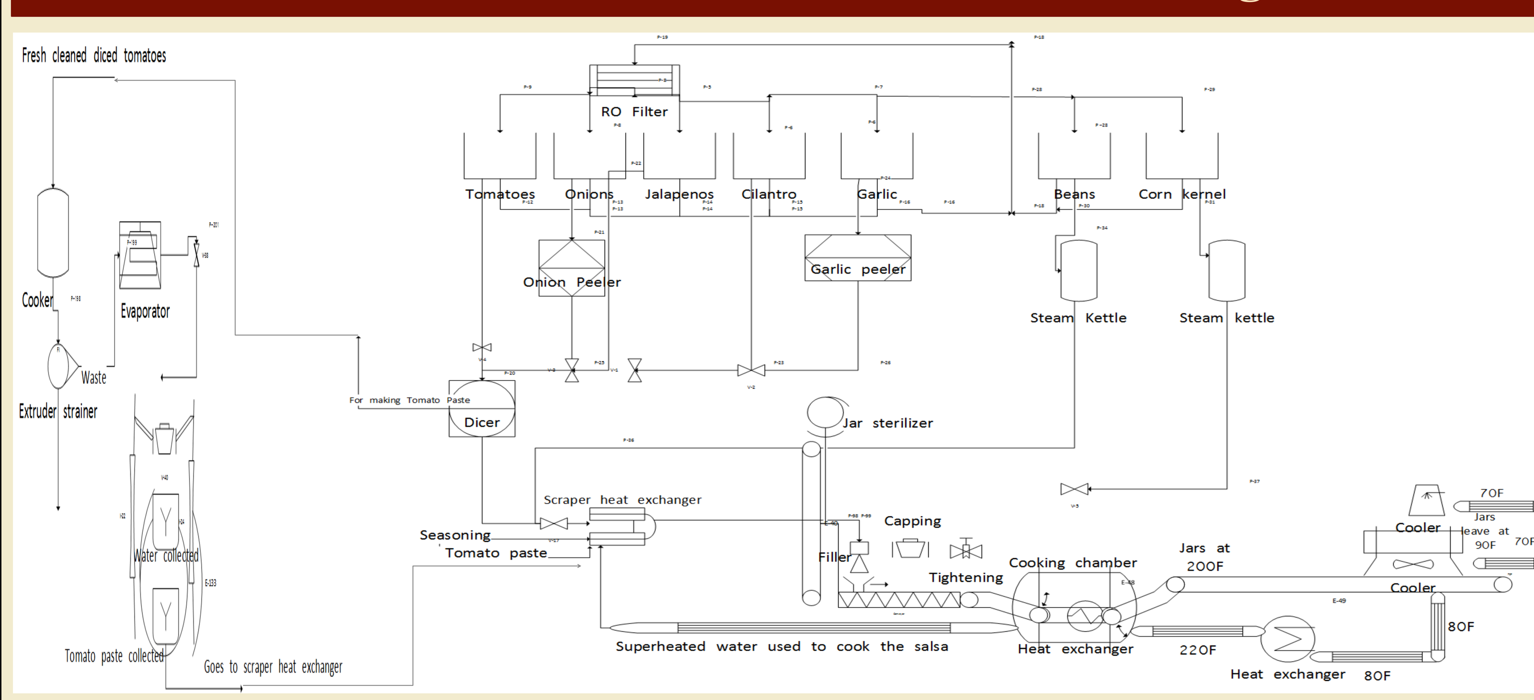
	Weight (kg)
Before Cooking	3.22
After Cooking	3.09
Water Loss	0.13
Vegetable waste	0.2109
Total Initial Mass	3.5609

Nutrition Facts
Serving Size 30
Servings Per Container 15

Amount Per Serving	% Daily Values*	Amount Per Serving	% Daily Values*
Total Fat 0g	**0%**	**Total Carbohydrate** 4g	**1%**
Saturated Fat 0g	**0%**	Dietary Fiber 1g	**4%**
Trans Fat 0g		Sugars 2g	
Cholesterol 0mg	**0%**	**Protein** 1g	**2%**
Sodium 120mg	**5%**		

Vitamin A 4% • Vitamin C 10% • Iron 2%

Final Design



Equipment	Size	Cost ($)
Scrap surface Heat Exchanger(Area and Length) and centrifugal pump (Power)	$4.7m^2$, 3.75m, 940 W	33290
MVR Evaporator (Heating tube Surface Area and Compressor power)	$2.817*10^{-3}$, 11.808 kW	4088
Cooking chamber:Heat Exchanger (Heating Surface Area,Cooking time)	$0.042m^2$, 107.475mins	3202
Cooler: Double-Pipe Heat Exchanger (Heating Surface Area,Cooling time)	$0.042m^2$, 87.746 mins	3202

Economic Analysis

Annual Costs	$ per yr.
Raw materials	185041
Water	9.08496
steam	8.908
Electricity	5115.36
Labor	29000
Maintenance cost	2982.66
Packaging	11648.07
Total Annual Cost	233805.083

It was determined that selling our 16 oz. salsa at $3.52 and doubling production every year would result in a payback period of 7 years for a 20% Return on Investment.

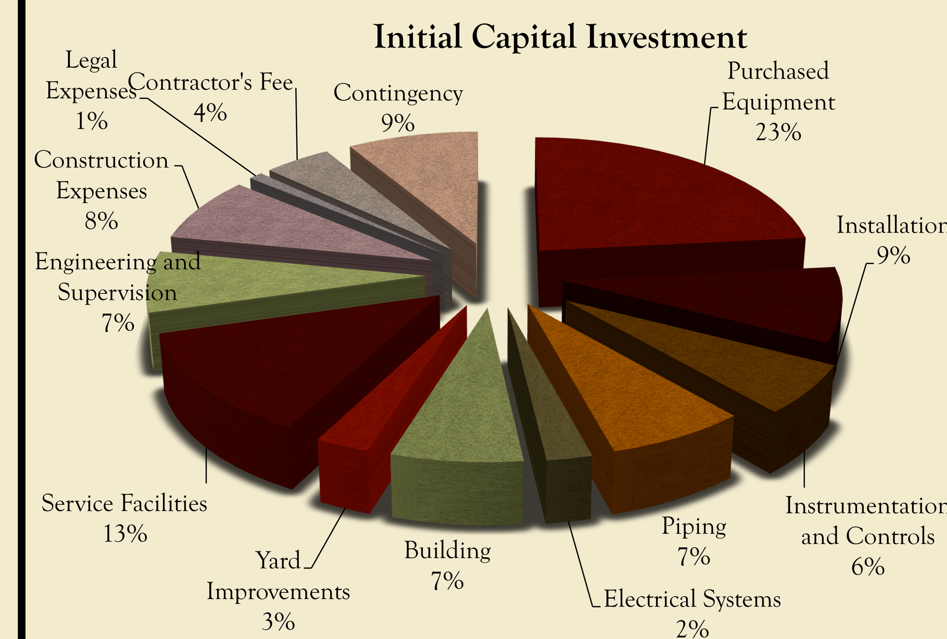


Fig 6: Percentage distribution of Initial Capital Investment

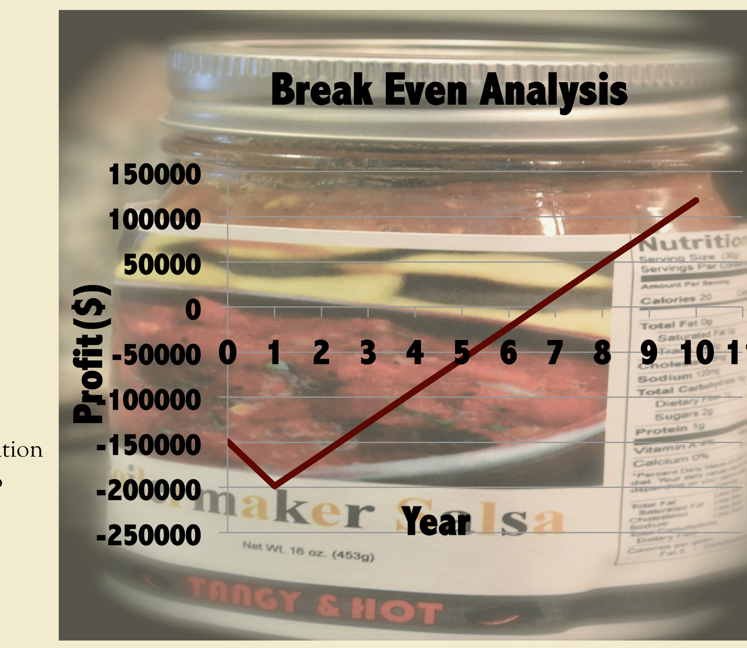
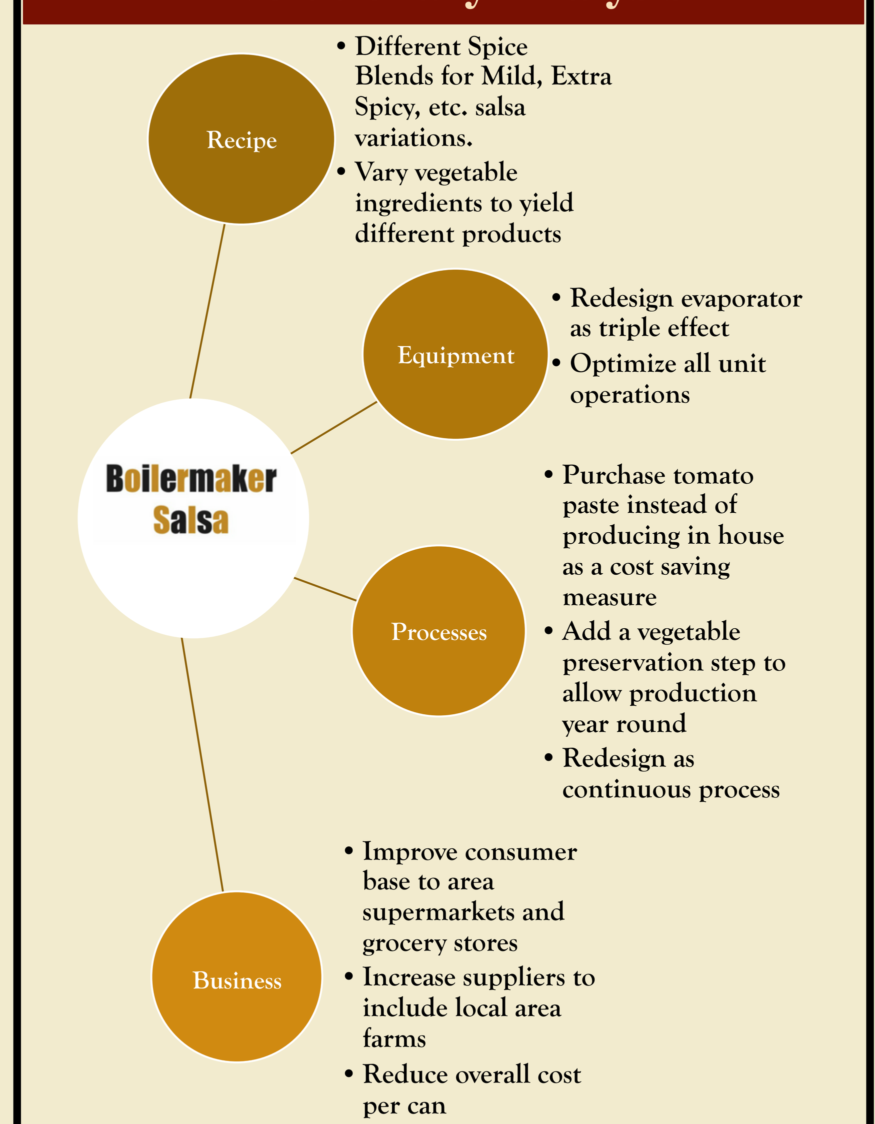


Fig 5: Break Even Analysis showing the time taken to make 20% ROI

We calculated a fixed capital investment at $642,000 and working capital at $112,500 to make the total capital investment amount to $754,500

Evolutionary Analysis



Global/Societal Impact

Technical Advisor & Instructor: Dr. Okos

Acknowledgements: Dr. Okos for his assistance in designing the process and providing lab equipment for our experiment

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